

REMARKS/ARGUMENTS

Applicant responds herein to the Office Action dated April 19, 2005.

Claim 1 stands rejected under 35 U.S.C. §102(b) as being anticipated by Rose, et. al. (5,967,156). Claim 2 stands rejected on grounds of obviousness over Rose and claims 1, 2, 5, 6 and 8 are stated to be obvious over Japanese patent publication no. 11-233481, in view of Tateyama (5,803,970). Reconsideration is requested in view of the amendments to the claims herein and the following remarks.

Preliminarily, the applicant acknowledges the Examiner's **Response to Amendment**, as set forth at page 4 of the Office Action, but nonetheless, respectfully submits that the instant amendments and the accompanying remarks clearly address those issues and demonstrate the claims of record to be directed to patentable subject matter.

The present invention recited in claims 1 and 5, as amended, features the following:

- a) The first gas discharge element (first nozzle) and the second gas discharge element (second nozzle) each spray an inert gas in substantially a single gas phase onto the surface of a substrate;
- b) The second gas discharge element (second nozzle) sprays the inert gas onto the same region as the region previously sprayed with the inert gas by the first gas discharge element (first nozzle);
- c) The first gas discharge element (first nozzle) and the second gas discharge element (second nozzle) are arranged in such positions that respective flows of the inert gas from the first gas discharge element (first nozzle) and the second gas discharge element (second nozzle) do not interfere with each other;
- d) Arrival points of the inert gas discharged from the respective ones of the first gas discharge element (first nozzle) and the second gas discharge element (second nozzle) draw loci directed from the rotation center of the rotated substrate toward the edge; and
- e) The flow rate of the inert gas from the second gas discharge element (second nozzle) onto the substrate is higher than the flow rate of the inert gas from the first gas discharge element (first nozzle).

Namely, according to the present invention, an inert gas is sprayed twice to completely remove deionized water deposited on a substrate for drying the substrate. The foregoing features a) through e) are functionally and cooperatively associated so as to completely remove even a minute amount of residual water on the surface of a substrate. Thus, the surface of the substrate can be dried with stability and reliability. More specifically, an inert gas in a single gas phase is sprayed at a low flow rate from the first gas discharge element (first nozzle) onto the surface of a substrate on which water adheres and the first gas discharge element (first nozzle) is moved so that the arrival points of the inert gas from the first gas discharge element travel from the rotation center of the substrate toward the edge, thereby roughly washing away residual water in a visually recognizable amount on the surface of the substrate from the center toward the edge. Next, the inert gas in a single gas phase is sprayed at a high flow rate from the second gas discharge element (second nozzle) onto the same region as the region from which the residual water has been removed. Thus, even a very minute amount of residual water existing, for example, in a fine pattern, can be completely removed to totally dry the substrate.

In contrast, according to the cleaning technique of Rose, two nozzles are used to spray aerosols onto the surface of a substrate 52 to remove foreign material 10. This technique is, however, completely different from the present invention in which an inert gas is sprayed twice onto the surface of a substrate to which deionized water adheres to dry the substrate. As indicated by the Examiner, in Fig. 5, Rose shows two gas nozzles 98 and 100 for discharging nitrogen gas. However, as recited in column 11, lines 45-57, these gas nozzles 98 and 100 are provided for discharging an inert gas for accelerating an aerosol 90 of relatively low velocity. This reference further explains in column 2, lines 8-12, that an “aerosol” means a gaseous suspension of microscopic particles of a liquid, or a mixture of solid and liquid. Accordingly, the two gas nozzles 98 and 100 of Rose do not spray an inert gas in substantially a single gas phase onto the surface of a substrate, but spray a material in a mixed phase of gas and solid or liquid onto a substrate.

As clearly seen in Fig. 5, the respective flows of a gas from the gas nozzles 98 and 100 interfere with each other. Rose also fails to teach that the nozzles 98 and 100 are moved so that arrival points of the gas discharged from the respective ones of the two gas nozzles 98 and 100

travel from the rotation center of the substrate 52 toward the edge. This reference still fails to teach that the flow rate of the gas discharged from the gas nozzles 98 and 100 differs therebetween.

The Examiner asserts that to adjust the flow rate of the gas nozzles 98 and 100 is deemed to be an obvious matter of operation in order to obtain optimal results (see page 3 of the outstanding Office Action). However, according to the present invention, an inert gas is sprayed at a low flow rate to roughly wash away residual water, and thereafter the inert gas is sprayed at a high flow rate to completely remove even a very small amount of residual water existing, for example, in a fine pattern to dry the substrate. These effects produced in the present invention are different from and not predicted in Rose. If, conversely, the flow rate of an inert gas from the second gas discharge element (second nozzle) is lower than the flow rate of the inert gas from the first gas discharge element (first nozzle), namely, if the inert gas is sprayed at a high flow rate and is thereafter sprayed at a low flow rate, splashes of water may occur or water droplets may partially remain on the substrate during discharge of the inert gas from the first gas discharge element. Further, there is substantially no drying effect during discharge of the inert gas from the second gas discharge element. Still further, Rose completely fails to provide motivation to obtain a high degree of drying effectiveness by spraying the inert gas at a higher flow rate from the second gas discharge element than the flow rate of the inert gas from the first gas discharge element. Thus, the Examiner's assertion in this regard is not proper.

As discussed, Rose completely differs from the present invention in completely failing to teach at least the above-mentioned characteristic features a(, c), d) and e) of the present invention recited in claims 1 and 5. Thus, the present invention is not anticipated by or made obvious from Rose.

Turning to Japanese patent publication no. 11-233481, the apparatus taught therein includes an element 4 for supplying gas to reduce surface tension of a liquid and an element 5 for supplying the liquid both provided to one movable arm 3. According to this reference, liquid is supplied from the element 5 onto a substrate and gas is supplied from the element 4 to reduce the surface tension of this liquid. That is, liquid, and not gas, is discharged from the element 5.

Thus, this reference also completely fails to teach that an inert gas is sprayed twice onto the surface of a substrate to dry the substrate.

Turning to Tateyama, this reference teaches gas nozzles 457A and 458A for supplying heated nitrogen gas onto a substrate G. However, according to Tateyama, the gas nozzle 457A sprays heated nitrogen gas prior to supply of a solvent (liquid) from a removing nozzle 451A, and the gas nozzle 458B sprays heated nitrogen gas after the solvent has been supplied (see column 36, lines 43-57). That is, gas supply in a previous stage, solvent supply and supply of drying gas are sequentially performed in this order. This teaching is completely different from the present invention in which an inert gas is sprayed twice onto the surface of a substrate to dry the substrate.

Both Japanese patent publication no. 11-233481 and Tateyama completely fail to teach an idea of spraying an inert gas twice onto the surface of a substrate to dry the substrate. Thus, even the combination thereof also fails to obtain the present invention.

Therefore, the applicant has clearly shown that none of the claims of record are either anticipated, nor rendered obvious by the prior art of record.

Accordingly, the Examiner is respectfully requested to reconsider the application, allow the claims as amended and pass this case to issue.

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Mail Stop AF, Commissioner for Patents P.O. Box 1450, Alexandria, VA 22313-1450, on July 19, 2005

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